Sailor's Propos[illegible]

For finding his

LONGITUDE

BY THE

MOON.

Offering at an eaſy and practical Way of performing it Now, by the Moon's Visible apparent Equinoctial Distance.

The whole Proceſs being within the Power and Capacity of every Mariner who underſtands the Art of Navigation.

With the Manner of making the Common Instruments fit for the Purpoſe: And alſo a Deſcription of a New One, by which the Altitude may be taken more exactly, *with Directions for rectifying it.*

The Second Edition.

To which is added an Appendix, ſhewing that in working by the Moon's Zenith Diſtance, the Parallax is of no Uſe. Alſo ſome New Conſiderations on the Lunar Eclipſe.

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Sailor's PROPOSAL

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MOON.

A Sailor's Propoſal

For finding his

LONGITUDE.

HE Moon makes its Zodiacal Revolution in ſo ſhort a Space of Time, as hath given great Hopes, that Means might be found of diſcovering its Motions by Obſervations with Inſtruments, and thereby calculating the Difference of the Longitude of Places after ſome ſuch manner, as the Latitude of Places is found by Obſervations from the Sun; for in thoſe 8 Signs of the

12 which are neareſt the Equator, the Moon alters its Declination from 7 or 8 Minutes an Hour, to 12 or 13; (I purpoſely avoid Exactneſs). In the other 4 nearer the Tropicks, the Alteration is not ſo much in an Hour; therefore not ſo perceptible in leſſer Diſtances; tho' in long Runs, and great Departures from the firſt Meridian it is very perceptible, and therefore would be little leſs uſeful than the other. The Thing deſir'd, then, is to diſcover this Variation of Declination, by ſuch Obſervation, if it might be done.

BUT ſo much Difficulty hath attended the finding the Moon's true Place, at leaſt of framing Tables for it as for the Sun's, that it hath hitherto been thought impracticable; eſpecially ſince a ſmall Error, of a Minute or two in the Declination, is ſuppoſed to cauſe a great one in the Longitude, which comes to be calculated by it; and ſo certainly it would be, were there not Hopes of preventing this Error, or diſcovering and knowing the Quantity and Proportion of it.

We therefore now propoſe to be conſider'd, what we truly want to know of the Moon's Motions, ſo far as concerns our preſent Purpoſe and no farther; and ſee if we cannot attain Our *End*, without enquiring ſo very critically into the Moon's Place, as is commonly imagined.

This Variation in the Declination makes the ſame Difference in the Moon's Altitude; ſo that if we are 15 Degrees departed from the Meridian of *London*, and the Moon declines 10 Minutes in an Hour, it hath alter'd its Altitude 10 Minutes, that is, it is 10 Minutes higher when it is on the Meridian in one Place, than when it is on the Meridian in the other.

Astronomers find a Difference between the Moon's apparent Declination, and its real Declination; but I am in hopes we ſhall have nothing to do to take any Notice of this; the Apparent *Diſtance* from the *Equator* is all we want, and we have no farther Buſineſs with that, but as it helps us to find an Altitude in a Place diſtant from us.

What-

WHATSOEVER Phænomenon it be, whether Sun, Moon, Star or Comet, whoſe Diſtance from the Zenith, (that is to ſay its Altitude) can be taken by Obſervation or found; and the Elevation of the Pole, (that is to ſay, the Latitude of the Place) alſo known; the Phænomenon's Diſtance from the Equator is alſo found.

IF its Equinoctial Diſtance is known, and the Elevation of the Pole, the Zenith-Diſtance is found.

IF the Zenith Diſtance, and the Equinoctial Diſtance is known, the Elevation of the Pole is found.

THESE are Things well known and underſtood by every Mariner, who can take an Obſervation from the Sun or Stars, and work it to find his Latitude by.

IF you have Tables of the Moon's Place, and Declination given you, or have calculated it your ſelf, and would know whether they are truly done, and fit for this Uſe, take an exact Obſervation

tion for the Altitude; and if the given Declination, and the Altitude obſerv'd make out the Complement of the Latitude, the Declination is truly calculated, and fit for our Uſe; if they do not make out the Latitude, (provided the Altitude be truly taken) the Declination is not truly calculated for OUR *Uſe*; but the Error is found, and the Proportion and Quantity of it; and you are certainly ſo much wrong in your given Declination, and no more nor no leſs than what your Altitude obſerv'd, and given Declination want of making out the Complement of the Latitude. And you muſt add or ſubſtract from your Declination accordingly; which when you have done, it is enough corrected, and the apparent Diſtance from the Equator is truly found for that Time, as far as is neceſſary for *our purpoſe*; if the Altitude be truly taken, and the Latitude truly known.

LET it be here remark'd, that we want only the *Moon's Altitude* in two Places; and we cannot come at the diſtant one, without having the Declination given us, or being able to calculate it; it muſt alſo be the APPARENT *Declination*

Declination; that is, such a *Distance from the Equator*, as appears to the Eye in an Observation, and no other; that the *distant* Altitude may be upon the same Footing with that which we take by Observation where we be: And if there should be any Error in thus trusting our Sight; yet by procuring the distant Altitude by a given Declination taken by Sight too, we have both on the same Footing, and the PROPORTION is kept.

IT doth not then much concern us, whether the given Declination be critically true or no, provided we have but the Altitudes true, as they appear to the Eye; and we can thereby find, how much the Moon hath alter'd its APPARENT Altitude, in passing between the first Meridian, (which we would fix at *London*) and the Place where we are distant from it.

IF the Moon's Place was found to as great an Exactness as you could wish, I don't see, but that there would be still more Difficulties to encounter than by this way which we propose; for we will admit that the Tables are fram'd to the greatest Truth and Exactness, and the

Errors

Errors of the Sight corrected, yet when we come to uſe them at Sea, we ſhall not be on the ſame Footing with them, and they will be ſtill more erroneous to us, for we muſt truſt our *Eyeſight* there, or we can't APPROPRIATE our Obſervations, nor our Calculations to the Place; we muſt have our own PROPER Altitude, ſuch as we can take our ſelves by our Inſtruments, and a *Declination* from thence too, if we want it at all.

IT is true, you may give Rules for correcting our Obſervations, and bringing them to your Tables, but I doubt they would be ſo many, as would too much embarraſs Seamen, and render the Work very troubleſome, and to moſt Sailors impracticable; even much more impracticable than that which we now propoſe; however, at preſent, we ſeem to have the Advantage of you, for our Way is practicable *Now*, which your's is not.

THE Method of finding your Diſtance (when you are at Sea) from the Meridian of *London* by the Moon, muſt be by taking with an Inſtrument its *Zenith Diſtance* when it's on

the Meridian, as exactly as poſſible; the Latitude of the Place muſt alſo be found by any of the uſual Ways but more exactly; this being done, you muſt find the *Altitude* at *London*, when it is on the Meridian there, which is only to be done by having the Declination in Tables for the Purpoſe, or calculating from Tables of the Moon's Place.

The Declination and Complement of the Latitude always make out the Altitude by the common Methods mention'd before, Page 6th. You have thus your own Meridian Altitude of the Moon, and its Meridian Altitude at *London*; find next the Difference of your *Latitudes*, by ſubſtracting the *leſſer Latitude* from the *greater*, and ſubſtract this Difference of *Latitudes* from your greater *Altitude*.

Thus have you both your *Altitudes* brought to the ſame *Parallel* of Latitude; and the Difference between them is what the Moon it ſelf hath made, by altering its *Equinoctial Diſtance*, in paſſing between the *Meridian* of *London*, and the *Meridian* of the Place where we are, which is the Thing required.

Or,

Or, take the Complement of your preſent *Latitude*, and the *Moon's Altitude*, which you have alſo now taken, and by theſe find the *Moon's* apparent *Equinoctial Diſtance*: Then take your given *Equinoctial Diſtance* for *London*, and ſubſtract one from another, and the Difference is what the Moon itſelf hath made in paſſing from one *Meridian* to another, according to the Proportion as before mention'd, Paragraph 1. and Page 5. § 2.

This muſt be the manner of working and obſerving to find the Longitude by the Moon; whether we ſtay till its exact Place be found, or whether we proceed now by making the beſt Uſe we can of what Knowledge we have already obtain'd of the Moon.

The Way here propos'd (as may be noted by what is ſaid before) is to conſider the Moon, as any other Phænomenon, and to bring our Calculations for the Declination, by which we find our *diſtant Altitude* upon the ſame footing with our *preſent Altitude* taken by Obſervation;

ſervation; nor do I deſire to call it Declination, but the APPARENT EQUINOCTIAL DISTANCE, becauſe it is only ſuch as it appears to the Eye.

NOW whether this *apparent Equinoctial Diſtance* may not be eaſier found and calculated than the *true* Declination, I muſt not here pretend to determine; I have not theſe Works of the Learned by me, which (it may be) ought to have been examin'd, but am under a Force and Neceſſity of publiſhing what I have to propoſe juſt now, and as it is.

TIME, Practice, Experience, farther Conſideration, and Aſſiſtance from others, may probably furniſh us with more artificial Ways of examining and regulating the Tables, than what is here propos'd; however this may do in the mean time, and ſerve for OUR USE till a better is found.

IN order to proceed to Buſineſs then, get the beſt and moſt accurate Tables you can of the Moon's Place, and alſo of its Declination, if it may be had, calculated for *London*, and to the preciſe Time of its coming to the South there every

every Day, or calculate this for your ſelf by thoſe Tables.

I Hope it will not be unreaſonable to expect that theſe Tables are very juſt and conſiſtent with themſelves, one part with another, and that if the Authors have not arriv'd to ſo great an Exactneſs as could be wiſh'd of calculating the Moon's Motions, yet that the Tables are at one *conſtant Proportion* of Diſtance from the true Place, and that they do not *vary* their Deficiency or Error.

Let it be remember'd that we are not going to calculate and eſtabliſh Laws for the Eclipſes for Years to come, therefore that Deficiency which ſo much incommodes them for the Purpoſe of Eclipſes, may not affect us at all.

When you have theſe Tables, before you, go to Sea, try if they are fit for your Uſe, thus.

Let an Obſervation be taken for the Altitude with a very large Inſtrument, (either by your ſelf, or get ſomebody to do it for you) after the manner deſcribed in Page 7th aforegoing; and if they

are

are not calculated for the *Apparent Equinoctial Distance*, which will be discover'd by the Observation, take Notice of the Difference, and set it down to allow it as often as you use them.

IT may be objected that the Tables will vary their Difference from your Eyesight, and will not differ so much at some Times as at other Times, notwithstanding their being just and consistent with themselves; because the Moon's *apparent Place* may not be so far distant from its *real* Place, when it is nearer us, as when it is farther off, our Eyesight making a greater Error at a greater Distance.

BUT this is also to be remedy'd, by making two such Observations, one when the Moon is near the Tropick of *Cancer*, and the other when it is near the Tropick of *Capricorn*; which will soon discover the PROPORTION you are to alter your given Declination to.

THIS Regulating of the Tables may be done at any Place distant from *London*, and that not only before you set out on your Voyage from any other

Port

Port in *England*, but alſo at any Port where you ſhall arrive, you may repeat theſe Obſervations; but Care muſt be taken that it be not attempted but where the Longitude as well as Latitude is perfectly known and eſtabliſh'd.

When theſe Things come to be conſider'd, they will not be found to have much Trouble or Difficulty in them; nevertheleſs we hope to be aſſiſted, and have theſe Corrections and Allowances done for us.

Or, I dare ſay, if any Perſon hath a mind to have it done out of hand, he need not ſeek farther than to ſome of our beſt Teachers of Aſtronomy and Navigation; or even the Publiſhers of our Books of Navigation, Seamen's Kalendars, and Makers and Sellers of Inſtruments to us, are always acquainted with ſome who are very capable, and would be very ready for a reaſonable Conſideration, to calculate Tables of the Moon's Declination, and alſo take Obſervations for us, and in our Sight if required, to ſee how they differ from the *apparent Equinoctial Diſtance*, and aſſiſt us in forming the Allowances which are to be made into a Table.

I Might

I Might also here mention its Distance in the Zone of the Zodiack on either side the Ecliptick, and have proposed to chuse the Times of Observation, when by the *Ephemeris*, or the *Tables*, I find it in its greatest *Latitudinal Distance*, which I think is above 5 Deg. to the Southward, and as much to the Northward of the Ecliptick, to see if any Difference appears on *this* Account.

An Objection may also arise, that in Process of Time the Error in the Tables will increase, and when we are in the *East* or *West-Indies* this may be of Detriment to us; but this also will be discover'd by these Observations being repeated, and the *Proportion* of it found.

I Don't see any Cause to fear our Success; we must in a very short Time, by this or such like Means, attain our End, if we do but once make a Beginning, and set about it heartily.

There are strong Reasons to hope it may not be so difficult to procure Tables of the Moon's *apparent Equinoctial* Dis-

Diſtance, as is imagin'd; for if in calculating Eclipſes you find your ſelves ſo little out, as that the Eclipſe happens not to your Time within 3 or 4 Minutes; it's true, by this, and Compariſons with the Motions of other Cœleſtial Bodies, you find the Moon's REAL PLACE was not truly calculated; but it is very likely this might not affect us much, for if in a ſhort Time before or after the Eclipſe, you wanted only the Moon's *Meridian Altitude*, as it *appears to the Eye*, you would not perhaps find much Error.

WE will therefore take it for granted, that by this, or ſome ſuch like means, we can attain to know the Moon's Altitude at *London*, when we are at any Diſtance from it.

As near the Truth then as we can take the *Moon's Altitude* at Sea, and as near the Truth as we can find the *Latitude at Sea*, ſo near the Truth can we find the *Moon's Altitude* at two diſtant Places, and conſequently the DISTANCE of their MERIDIANS.

THE whole Operation then depends on finding an *exact Latitude* at Sea, and taking an *exact Altitude*.

AND this, ſome, I don't queſtion, think ſo difficult to obtain, that they will at firſt Sight, till they have a little better conſider'd it, be terrify'd from attempting it; for, ſay they, (and juſtly enough too) *half a Minute*'s Error on my Inſtrument is a whole *Degree* of *Longitude*, when the Moon makes ſeven Minutes and a half Variation of Declination in an Hour; but in the *Latitude* 5 or 6 or 10 Minutes Error on my Inſtrument are but ſo many Miles, which is a Trifle.

THERE are three Cauſes of this Objection, of which there is but one of any conſiderable Moment. The firſt is, there having hitherto been no Neceſſity for a nice Obſervation at Sea for the Latitude, is the Cauſe it hath not been endeavour'd after; but when People ſee an apparent Benefit in a more diligent and careful Obſervation, this Cauſe of the Objection will be remov'd; and yet I know not, but it may be a principal one

one in its Conſequences, tho' trivial in its ſelf. A ſecond Cauſe of Objection lies in the common Inſtruments, which are not made for nicer Obſervations; but this is alſo eaſily remedy'd, for both *Davis's Quadrant* and the *Foreſtaff* are very proper, were they but about *Six Inches* longer each of them, and this would not render them a whit leſs commodious for Uſe at Sea; and they might be then divided, (as the Makers beſt know how) to *ſixths* of a Minute; and this would leſſen conſiderably any Inaccuracy in the obſerving, for, as before he miſtook 5 or 6 of his Diviſions, which were then ſo many Minutes; if he makes the ſame Miſtake now of 5 or 6 Diviſions, it will be only ſo many SIXTHS of a Minute: But there is one Thing too often neglected, which hath made ſome ſeeming Errors in Obſervation, and that is, forgetting to allow for the *Sun's* VARIATION of *Declination* according to the Diſtance you are from the firſt Meridian, which is ſo conſiderable in a long Run and Departure from the Meridian, that it is worth while to take an *Obſervation* for it, eſpecially when your Inſtruments are made larger and divided to the ſixth of a Minute; for at the

Departure of 90 Degrees of *Longitude*, if the Sun is near the Equator, or within a Sign or two, it varies 20 or 24 Minutes in a Day, which in ſix Hours is 5 or 6 Minutes, and may IT SELF, if accurately obſerv'd, help you in diſcovering your *Meridian Diſtance*; and this is very convenient to be done, when it may be done. It is not only of conſiderable Uſe, but alſo pleaſant to ſee it correſpond with your Obſervations from the *Moon*, tho' it cannot be done to any great Satisfaction, when the *Sun* is on the Tropicks, or approaching near them.

HOWEVER this may ſerve at leaſt to ſhew the Error of not allowing for this, which I know to be too much neglected, notwithſtanding there are in ſome Treatiſes of Navigation, Tables on purpoſe to ſhew it; and in vain may you puzzle yourſelves to make your Obſervations by the Sun and Stars correſpond with one another, if you don't ſet off this *Variation* of the *Sun*'s Declination.

THE third Cauſe of the Objection of the Difficulty of an exact Obſervation,

on, and which is indeed the only one of any Weight, is, that it is difficult to ſee a *true* HORIZON; and as all Obſervations at Sea are taken from it, *Haziness* doth frequently interrupt, and, for ought we know, raiſe or depreſs it to our Sight; and this is moſt likely to incommode us in our Obſervations for the *Moon* and *Stars* by Night, than of the *Sun* by Day; this therefore we muſt ſee if we can't find a Remedy for.

WE ſhall not here pretend to dictate or teach thoſe who know better than ourſelves, but only *propoſe* at preſent, what occurs to our Thoughts to be conſider'd on.

FIRST then, we deſire it may be conſider'd, whether an Obſervation may not be taken by the *Foreſtaff*, from the *Moon* to ſome *known* STAR, a little Diſtance from the *Meridian*, inſtead of to the *Horizon?* It is no matter on which Side the *Meridian* it is, or whether above or below it, only not farther off than *half an Hour*, or *an Hour and an half*; and if you pleaſe you may take an Obſervation at the ſame Time from the *Moon* to the *Horizon*, it is only putting

ting two Vanes on the Staff at one time, which will make a Croſs with one another, and you may look ſometimes at the *Moon*, and the *Horizon*, and by turning the Staff ſometimes at the *Star*, and the *Moon*; now this STAR being one of thoſe, whoſe *right Aſcenſion* and *Declination* we ſuppoſe to be truly known, its exact *Altitude* and alſo its Diſtance is truly known, from the neareſt Part to it of the *Meridian Line*, in which you are now obſerving the *Moon*, and from which it is lately departed or approaching to.

THIS is much facilitated by the true time of Night being known by the Moon's Southing, which is given you in your Tables from *London*; this Diſtance of the *Star* from the Point in the *Meridian Line* is of the ſame Heighth with its ſelf, and is the Baſe of your Triangle; the *Perpendicular* is that Part of the Meridian Line which is above the aforeſaid Point to the Point of the Moon's Heighth, and the *Hypothenuſe* is the Diſtance obſerv'd from the *Moon* to the *Star*. I dont deſign to proceed any farther on this, my Buſineſs is not to teach *Trigonometry*.

THIS

THIS may be alſo done to a *Star* on the *Meridian* at the *ſame Time* with the *Moon*, but at preſent it ſeems more eligible to me to prefer the other; for having a *Point* in the *Meridian* Line given equal to the Height of the *Star*, diſtant from it; you have as good as *three* Obſervations in one; *viz.* this from the *Point* found, that from the *Star* it ſelf, and the other from the *Horizon*.

MAY not a correct Obſervation be made by *Davis's Quadrant* as from the Sun, and inſtead of looking through the *Horizontal Vane* for the HORIZON, look through it at ſome known NORTHERN STAR, which is not too high above the *Horizon*? this hath one (if not more than one) Advantage of the other, and that is, you have no Occaſion to take any Notice of the Moon's Diſk. There is no room to mention a *Quadrant* with a *Pendulum*, which, it is true, anſwers all theſe Intentions at Land, but no Uſe can be made of it at Sea.

BUT one may be made for this Uſe, by adding to a pretty large Quadrant a PENDULOUS LIMB or Ruler, moving

on the Center of the Quadrant as usual: This *pendulous Limb* is prolong'd by a Process of it, to a considerable perpendicular Height above the Center; on this *Process* is a MOVEABLE VANE, with a *Sight* in it, (and then there needs but one more Sight to the Quadrant) or a NEEDLE to be taken with the *Sight* or *Sights* on the upper Edge of the *Quadrant*; now this *Sight* or *Needle* on the Vane, which moves on the *perpendicular Process* of the *Pendulum*, can never be seen through the other *Sights*, but when the *Pendulum* is TRULY *Perpendicular*; by which means, the Pendulum becomes an IMMOVEABLE TRUE PERPENDICULAR LINE, the Quadrant moving on *that*, not *that* on the Quadrant; and this *perpendicular Process* being a Line of *Secants*, the moving *Sight* shews a *true* Secant at the same time that the lower Part of the *Pendulum* shews the true Degree and Minute on the Great Arch.

THIS VANE may be mov'd at Discretion by the *Hand* or by a RULER, fix'd an Inch or two above the *upper Edge* of the Quadrant and Parallel to it, on which *Ruler* the *Sight* must be

fix'd

fix'd better than on the Edge of the Quadrant; this RULER is alſo prolong'd to a proper Length beyond the Center, and moves to the other *perpendicular Proceſs* of the Pendulum like a Pair of Sciſſars, interſecting one another in SECANTS and TANGENTS, and the moving Sight cuts and ſhews both; for as *that* is a Line of Secants, ſo *this Ruler* is a Line of Tangents: There ſhould be ſome farther Deſcription of theſe two Parts of it, but the beſt I can do on this Manner will be imperfect.

I DESIGN'D here to have given the Form of it in a Cut, but am hindred in my Intention by an Impediment, which I can't at preſent remove; however, this is ſufficient to ſhew I deſign to make no Secret of it; beſides I am ready to gratify any Gentleman, who ſhall think it worth his while, with a plain and full Deſcription of it.

I MAKE no doubt, but when the Thing is once agreed on, but Means will be found to take the *Altitude* exact enough, or to correct the Inaccuracy of the Obſervations for it, which is the ſame Thing. We will ſuppoſe then the

Altitude taken as well as it can be done; before you proceed to calculate for the Difference of *Longitude*, the *Latitude* muſt alſo be found, which may be done by taking it at the ſame time, or ſo near the ſame time, that your Ship hath not run any Diſtance, which may cauſe an Error.

THIS muſt be done with as large an Inſtrument and as exact as the other; but there are ſo many ways of taking Obſervations for the *Latitude*, eſpecially every Day by the *Sun*, and alſo of correcting them by taking *Amplitudes* and *Azimuths*, and by comparing one with another, and by other *Calculations*, that but little need be ſaid here on that Head, only that I would have them calculated to the ſixth Part of a Minute.

THE Latitude then being thus found to the ſixth of a Minute, *i. e.* to ten ſeconds, and the *Latitude* of *London* alſo known to the ſame Exactneſs, Proceed to your Operation by one or other of the Methods in Pages 10 and 11, that is, by bringing both the Altitudes into one parallel of Latitude, or by finding the Moon's Equinoctial

tial Distance in the Place you are, which is done by the *Complement* of the *Latitude*, which we suppose is now taken from some *Star*, and by the *Moon's Altitude*; this done, substract your *Equinoctial Distances* one from another, (that is to say your given Declination at *London*, and that you have now found,) and the Difference between them is the Thing sought.

Look then into your Tables that are, or are to be, prepar'd on purpose, or calculate for yourself to find how many Minutes the *Moon* alters its *Altitude* by *Declination* in an Hour at the time of your Observation; as if it be seven Minutes and an half, you have then 30 Seconds or 3 Sixths of a Minute to a Degree of Longitude; and tho' this seems but small at the Distance of one Degree, yet in a longer Run, it is Vastly *considerable*, especially when the *Moon* varies 10 or 12 Minutes an Hour; but we will suppose only 7 Minutes an Hour, and in six Hours Time you will have 42 Minutes Difference of *Altitude*, which answers to 90 Degrees of *Longitude* from *London*, where I would have the first Meridian fixt.

My Buſineſs is not here to go through the whole Proceſſes of theſe Things, nor to pretend to, or aim at Perfection, only to Offer ſome Proposals as a Foundation to proceed on, and give *general Sketches*, which are to be improv'd and perfected by Practice and Time; yet I would not willingly be ſo ſhort and obſcure as not to be underſtood by every diligent and curious Practical Navigator, tho' I deſign not to teach him *Aſtronomy* and *Mathematicks*. I have therefore nothing more to ſay on this Head at preſent that is material, (eſpecially till I ſee how this is receiv'd) only to review our Undertaking, and conſider what help we want in order to a Proficiency.

Among which is, that we be directed to juſt and correct *Tables* of the *Right Aſcenſion* and *Declination* of the *Fixt Stars*, and if they are not yet corrected, that they may be review'd and corrected; beſides the principal Uſe of this, I am aware of an Objection againſt me for propoſing one of thoſe *Stars*, for one of our Points of Obſervation inſtead of the *Horizon*; but *Query*, may not

not this be regulated by having our Time exactly given by the Moon's Southing?

We want also a Table containing the Precise Time of the Moon's coming on the Meridian at *London*. In one Column its Declination as near as it may be, in another Column the Minutes it varies its *Equinoctial Distance* in an Hour, at the Time of its southing there; as also to every ten or fifteen Degrees in every *Sign* through the *Zodiack*, &c.

There are other Things which have not escap'd my Notice, but are rather Purposely *omitted*, chusing to propose them by way of Query, for further Instruction and Consideration, from more *able* Directors; among the which are these.

Query 1. Would it be proper to observe by the upper or lower Verge of the *Moon's Disk*, and allow for it? Or is it not enough to take, as near as one can, the Center of the Moon? Or wou'd it not be Yet more proper to have the Calculations in the Tables made to *two* of those Visible Spots

in

in the *Moon*, the one on the *East*, the other on the *West* Side?

2. Will it be of Use to us to consider of any Alteration of TIME in great Distances of *Longitude* and *Latitude*?

3. IF the Hint of observing by the SHADOW with *Davis's Quadrant* is not likely to be useful? And what *Stars* are most convenient for the Purpose?

4. IS not the Moon's *Apparent Equinoctial Distance* ALREADY exactly enough known, and to be fram'd into Tables NOW with great Ease, according to our Meaning, for this Purpose?

THE greatest Reason which makes me doubt it is, that this Method hath not yet been put in Practice; and this is the true Cause of the DIFFIDENCE, which is so evident to be seen throughout *this Proposal*, and of the Caution of trying the Tables by Observations, for fear of some latent Impediment, which I cannot penetrate into.

YET I have some Hope, when I consider, this is not the first Time, that

Dif-

Diſcoveries, the moſt beneficial to Mankind, have been taken from ſuppos'd ignorant Perſons, or found as it were by Chance; the learned and laborious Searchers after Knowledge do ſometimes dazle their Eyes, and amuſe themſelves, and one another, by very operoſe and critical Enquiries; and thereby let ſome eaſy and obvious Thing, which would bring about the *End* and *Benefit* aim'd at, eſcape their Notice.

THE Caſe may then be thus, great and learned Aſtronomers, when they think or talk of the *Moon's Declination*, to be ſure mean the REAL *one*; this, they think, is not accurately enough to be ſettled; but they never conſider, that we have nothing to do with the real one, if it differs from the apparent one, we want nothing but the *Apparent Equinoctial Diſtance* at *London*; ſo that in ſhort, the Matter is too *low* and *mean* for them to think on.

AND Sailors, who never ſee any Tables at all of the *Moon's Declination*, as they do of the Sun's and Stars, never can have any Thought or Expecta-

tion

tion of any ſuch thing; and thoſe very few *Mariners* who are more curious and know the great *Variation* the *Moon* makes in an Hour of its *Equinoctial Diſtance*, yet diſtruſt their own Capacities, and depend on the more Learned; and this hath been the true State of the Caſe till this Time.

THEREFORE, I would not have my Brother Sailors to be at all diſcourag'd, becauſe they ſee me propoſe it with ſo much Caution and ſeeming Doubt, for I am more cautious and diffident on my OWN *Account*, the Thing being of that prodigious Importance in the Conſequence of it, than to doubt at all on the Matter of Fact; for the Moon's APPARENT *Declination* (which I chooſe to call its Equinoctial Diſtance) may moſt certainly be at preſent calculated with very great Eaſe, and fram'd into Tables for their Purpoſe, and they need not fear, but it will ſpeedily be done without troubling *them* with any of my Tryals and Provings by Obſervations. I have alſo here ſhew'd them how an Inſtrnment may be made with an immoveable Perpendicular; and tho' by my at preſent imperfect Deſcription

of

of it, can't ſee clearly the Form yet there is enough deſcribed to let any ingenious Man ſee, that ſuch an one may be made: Nor let any one imagine, we have been contriving a vaſt unwieldy Thing, with a Ruler and Perpendicular of ſuch prodigious Lengths, to ſhew the Tangents and Secants, as would render it uſeleſs; for this is remedied too, by having two of thoſe Rulers, one projected from a very ſmall Quadrant, to ſhew the latter larger Tangents and Secants from 50 to 80 and upwards, and another projected from a very large Quadrant, to ſhew the ſmaller Tangents; theſe are to be changed as Occaſion requires, after the manner of the Croſſes of a Foreſtaff: By this the Altitude of the *Moon* and *Stars* may be taken moſt commodiouſly, as well as correctly; for here is nothing to do with the *Horizon*, only the One Object, which you are obſerving, to look at; and no Motion of the Sea can incommode them; but even without this Inſtrument, if they have but a *Foreſtaff*, or *Davis*'s Quadrant long enough, and divided to the ſixth of a Minute, and the Table of the Moon's apparent Equinoctial Diſtance,

(which will ſoon be publiſh'd) tho' they take their *Obſervations* to the Horizon, yet will they have with all that Diſadvantage, a way of keeping their WHOLE SEA RECKONING by COELESTIAL *Obſervations*; and whenever they can ſee the Moon, they have (at leaſt) an *Obſervation* for what *Degree* of *Longitude* they are in. But let it not be forgotten, that the Obſervations for the Latitude muſt be as nicely taken as this, or as is poſſible; it is alſo worthy of Remark, that by this Obſervation of the Moon, the Latitude may be alſo calculated; by which means, when the Latitude taken by the Sun and Stars, comes to be compar'd and corrected, this alſo may be corrected; which, when duly conſider'd, will be found of great Benefit; for this may correct an Error, and your whole Obſervation for the Longitude be thereby reviſed.

GIVE me Leave here to expoſtulate the Caſe a little, (ſince my Printer calls on me to fill up a Page or two more.)

SUPPOSE that this way of keeping our Reckoning by Obſervations from the

Sun

Sun and *Stars* for the *Latitude*, and by the *Moon* for the *Longitude*, ſhould be juſt now as uncertain and precarious as the dead Reckoning; yet it is ANOTHER Way, and is there not a vaſt *Advantage* in that?

WHEN one thinks of the many and weighty Objections againſt going to Sea, and truſting ſo much as we do to the Log; it is wonderful and even terrible to conſider, that ever People ſhou'd venture their Lives and Eſtates againſt ſo many ſeeming inſuperable Obſtructions.

THE very Length of the *Line*, was not agreed univerſally upon, no, nor the Number of Seconds for the *Half-minute Glaſs*; Some allowing more than others; then there's a Suppoſition, that the Ship may, during the Time of throwing the Log, run ſwifter or ſlower, than it doth before or after; and this very Objection itſelf, one wou'd think, ſhould have been enough to have over-throw'd the whole Deſign and terrify'd People from attempting it, there ſeems ſo much Reaſon in it. Then there's *Lee-way*, Currents, and Varia-

tion of the Compaſs, &c. all which you were ſtill left almoſt to gueſs at; they ſerving to confound the other Help you had from the Log, and not to be at all regarded or found by it.

Now take this, and the Propoſal we here make of obſerving for the *Eaſting* and *Weſting* by the Moon, and ſet them together; and ſee if our's doth not ſeem, in Reſpect of the other, to be a *certain* and *ſure* Way to be depended on: I ſay in compariſon with the other, there is ſo much greater a Proportion of Security; and as for the Advantages we have of it, there is no Compariſon, for we have *Lee-way*, *Inequality* in Swiftneſs of *Sailing*, *Variation* of Compaſs, and *Currents*; all found and allow'd in finding our *Meridian* Diſtance: But here lies the Difficulty, ſays a timorous indolent Objector; the *Moon*'s Place is not enough known, you can't take an Obſervation near enough?

But have we not provided againſt both theſe? Will not your Ship's *Eaſtern* and *Weſtern* Progreſs be known by this Obſervation? Will you not have an Al-

Alteration, and a very manifeſt one too, from the Time of your taking one Obſervation, to the Time of' taking your next? and will not this be in Proportion to the *Eaſtern* or *Weſtern* Diſtance you have ſail'd?

I deſire it may be conſider'd, which of theſe two Things, *viz.* the *apparent Declination* at *London*, and taking the *Altitude* at *Sea*, is ſo *precarious*, *uncertain*, and *liable* to *Errors* as the Log?

If you were only to take the Tables of the *Moon*'s Place, as they are *now*, ſeparate the *real* Place from the *apparent* Place, and form a Table at once without any other Care for the *apparent equinoctial* Diſtance, this itſelf wou'd not render the Undertaking under any ſuch Diſcouragements.

And as to the Expedient of examining theſe Calculations by *Obſervation*; tho' I propoſe it with ſome Diſtruſt, as not knowing how great Artiſts may like it: Yet when conſider'd, as done carefully with a large Inſtrument; and alſo the Time preciſely noted of the *Moon*'s coming on the Meridian, and trying if the

the *Time* as well as *Altitude* agree with the Calculation of TIME and ALTITUDE; I ſay, notwithſtanding my Diſtruſt, it muſt be very uſeful for finding the Error (if any) and the Quantity of it, and indeed takes off all Objections againſt the immediate going about it; and as for taking the *Altitude*, I don't ſee, how it can be at all mention'd in any Meaſure of compariſon with the Log.

IF you think the Moon's Place not enough known, and you like not my Expedient of examining the Calculations; Is not THIS THE WAY to find it by ſuch numerous and frequent Obſervations?

It is amazing to hear People complain of the Danger and Trouble of Navigation for want of a Way of finding their Longitude, while ſuch a *Phænomenon* is almoſt nightly in view? But ſome wrack their Brains in inventing perpetual Motions, and others in knowing the Moon enough to calculate its Eclipſes for Years to come; while ſuch a plain Way is not ſeen and try'd, and yet it muſt be allow'd in ſpite of all Oppoſition, to be A WAY PRACTICABLE, SATISFACTORY and IMPROVABLE.

IF

If Sailors ſay they knew it not before, and Aſtronomers ſay they did not know, that ſo inartful a Method would ſerve the Sailors Turns, it is enough that it is now known, and I hope will no longer be neglected.

That Objections will ariſe to this, I make no Queſtion of; ſome very *trivial* and *impertinent*, as is uſual in all ſuch Caſes, others of *more Conſequence* and worth Conſideration: I can ſee room enough, in this Infancy and imperfect State of the Thing, for Difficulties to be ſtarted; but I am of Opinion, there will hardly any Obſtruction ariſe, ſtrong enough to overthrow the whole.

It is very likely, that until we are greater Proficients in it, by repeated Tryals and Practice, we may not be able to be as certain of our Longitude, as we are of our Latitude, and it is very probable, never ſhall, to as few Miles, that is to 10 or 15 Miles; but that we may even now find what *Degree* of *Longitude* we are in, and make our Dependance on it, to 10, or 15 Leagues is pretty evident; and make handſome Allowances too, for

In-

Inaccuracies in taking the *Altitude*, and other Uncertainties; and this is near enough: We don't expect all at once to throw away our Log-line, and half-Minute Glaſs; it is very well if we have found a Way to correct our dead Reckoning.

The greateſt Objection I have againſt it, is, that ſome Part of it is a very odd Way of going to work, not enough like an Artiſt, to make the great and curious *Aſtronomers* like it; and it is this Diſtruſt is the Reaſon, it is not addreſs'd to them; yet I hope it may give them an Hint to produce ſomewhat more artful, let it be call'd then an Expedient, or what you pleaſe, it is a Practicable Way, of going about the Work; tho' at preſent not a perfect one, Time and Practice moſt certainly will improve you in it.

Whoever ſtays till every Objection and ſeeming Impediment is removed, will never arrive at any great Excellency.

The magnanimous and Induſtrious ſet out with a View and Reſolution to encounter Difficulties and Obſtructions; or they would never attain to any Thing greatly good.

FINIS.

An Appendix to the SAILOR'S PROPOSAL for finding his *Longitude. Containing ſome new Conſiderations on an Eclipſe of the* MOON.

THE Propoſal for finding the Proportion of the Error of the Tables for the Moon's Place is not only founded on the Reaſonableneſs of the Thing in it ſelf, but alſo on the following Conſideration of the *Lunar Eclipſe*, which no Body hath yet taken Notice of, or at leaſt not to apply it to Practice.

I have the ſtrongeſt Reaſons to think that the Moon's TRUE PLACE is already exactly found, and that by ANY Obſervations for its *Altitude* or *Place*, it will appear to be ſo, and that the *Declination* and SOLAR *Eclipſe*, or any thing thereunto relating, may be calculated except the LUNAR *Eclipſe*, which to me ſeems

ſeems no more likely to be found exactly, than the Quantity or Height of Water to an Inch of a Spring Tide, it being indeed a Parallel Caſe.

An Eclipſe of the Moon is cauſed by its coming into the ſhadow of the *Earth's* Atmosphere; now this *Atmoſphere* is an unequal inconſtant Fluid, riſing, falling, and fluctuating, and as appears by the Barometer, is a vaſt deal higher at one Time, and at one Place, than at another, according to the differing Seaſons in differing Times, and differing Parts of the Earth; and as it may be affected by Thunder, Froſt, Hurricanes, *&c.*

In Relation to an Eclipſe of the Moon, we muſt view it in ſuch an Idea as of a Fluid, the Extremities of which are bounded by an undulating Circle, whoſe Circumference is ſometimes larger and ſometimes ſmaller, as the Atmoſphere is higher or lower from the Earth, and conſequently the Shadow muſt be greater or leſſer in Proportion, and therefore ſooner or later in touching the Moon.

So that we may *obſerve* and *calculate* and correct and *obſerve* and *calculate* again for ever, before we can diſcover the true Time when the Moon ſhall

firſt

firſt touch this Shadow, nor when it ſhall go out of it, no nor the *Duration* or the middle of the Eclipſe, for this *Atmoſphere*, and its Shadow may not have equal Sides, it may alter during the Time of the Eclipſe, and one Side of the Shadow be leſs diſtant from the Center than the other.

And here appears the chief Reaſon why the Motion in the Syzygies is found truer than in the Quadratures, and that the greater Part of the Irregularities and Uncertainties ſo much complain'd of are owing to an Amuſement, which is thus produc'd.

The Moon's Place and Motions are found and calculated as by the *Solar Eclipſe* which happens in the Syzygies, appears very near, (and would be perfectly ſo, were it not for this) but when we calculate the *Lunar Eclipſe* from the ſame Laws as the *ſolar*, it eludes them, however the Moon Is eclips'd pretty near the Time, and from thence we go to mending the former Work thus.

The Point of the *Conjunction* is found by calculation, and the Solar Eclipſe confirms it, the Point of the Oppoſition we now ſee by the Lunar Eclipſe;

cliſe; the Quadrature muſt be a POINT exactly in the middle between them, but ſee here the DELUSION, the Shadow which caus'd the *Lunar Eclipſe*, is the Shadow of an inconſtant Fluid, and whatſoever Points, whether Oppoſition, Quadrature, or Octant are form'd from thence muſt be as inconſtant as it ſelf.

THE REMEDY is, neglect wholly the Lunar Eclipſe, and calculate the Moon's Places from one *Conjunction* to another.

THAT the Lunar Eclipſe is caus'd by this Shadow of the FLUID INCONSTANT *Atmoſphere*, that the POINTS of the *Oppoſition* and *Quadratures* are taken from thence, are univerſally evident and indiſputable Facts. I hope then it will be no Preſumption to ſay the *Propoſal* for finding the Longitude is built on a ſolid and invincible Foundation, and that not only the finding the *apparent Equinoctial Diſtance*, which is all we want, is eaſy and practicable, but we have here alſo ſhew'd the Way of finding the Moon's REAL PLACE by throwing the *Lunar Eclipſe* out of the Account, and thoſe who calculate the Tables for the *apparent Equinoctial Diſtance*, may find this very uſeful, they will proceed with greater

Aſſu-

Aſſurance; but I inſiſt on it, that by all I can ſee at preſent, the APPARENT *Declination* is leſs Labour for Mariners, better fitted to an APPAREET *Altitude*, and in every reſpect more proper.

I have met with an Objection from two or three ingenious Perſons, that the Altitude cannot be taken exact enough, be our Inſtruments never ſo perfect, from the very Nature of Viſion and Deficiency of human Sight: but I deſire they will conſider with Attention, what hath been ſaid in Pages 34, 35, 36, and alſo that this Error by Sight can be no more in a WHOLE *Voyage*, than what is made at ONE *Obſervation*; for every time you take an Obſervation it is a NEW *one*, for the Whole Meridian Diſtance from *London*, here is no accumulating of Errors, by adding the Errors of one Obſervation to another; on the contrary, the *preceding* and *following* Obſervations correct one another. A very uſeful Correction may alſo be thus made. Take the Moon's Altitude and the given Declination at *London*, and work it exactly as you do by the Sun for the Latitude, call this an *artificial Latitude*, this will differ from your true Latitude juſt as much as the Moon hath alter'd

ter'd its Declination in passing between the Meridian of *London*, and your own Meridian, compare this *Difference* of *Declination*; then with the *Difference* of *Declination* found by your Observation for the Longitude, as in Page 11, and 27, and if there is any Difference between the *Differences* of *Declination*, it is an Error in taking the *Altitude*; PROVIDED, your *Latitude* is true, you must then carefully examine and correct your *Latitude* one Observation by another, and by these means you will find out, and correct every Error. The *Log* is also kept still, and more useful because corrected oftner.

BUT Astronomers have already determin'd this, or they have been in vain searching with so much Pains for the Moon's true Place, if there is a Deficiency in human Nature, depriving us of the Benefit of it.

I can't help taking Notice here that I have made already *too* LARGE Allowances for this, and thereby not done my self and my Scheme Justice.

I propose to take my *Altitude* by an Instrument divided to sixths of a Minute, now if I could have expected this to be done exactly to the *sixth* of a Mi-

Minute, we ſhould have an Obſervation for our Longitude to 4 Leagues, and 3 Leagues, and to 2 Leagues and a half, for above two thirds of every Month, any where here about the *Britiſh Seas*. Inſtead of that I am contented to expect only to come to 8 10 or 12 Leagues, That is, I keep my Reckoning according to my Obſervation to the ſixth of a Minuit, which is to 3 or 4 Leagues; but I expect my ſelf to be in an Error 6 or 8 Leagues more, which will however bring me within Sight of Land, and I think my ſelf very happy too, and I dare ſay ſo will every Mariner think, who can truly conſider this Propoſal, and will confeſs he hath as much as he can wiſh, and more than he wants. We are ſeeking as *Sailors*, a means to keep our Reckoning juſt, and find our Longitude at *Sea*, we want not ſuch nice Obſervations as would eſtabliſh the Longitude of Cities and Towns on Shore to a Mile.

THUS by throwing out the Lunar Eclipſe, the Moon's TRUE PLACE is found; and in a critical Aſtronomer's own Way, the APPARENT EQUINOCTIAL DISTANCE is to be had; we have alſo ſhew'd Ways of taking and *correcting* the

the ALTITUDE for Uſe, and on theſe two Things our Propoſal is found, the SCHEME is therefore prov'd to be JUST, PERFECT and PRACTICALL.

AND we have made it as eaſy to obſerve for the *Longitude* at *Sea* as for the *Latitude*. The Inſtrument which we propoſe, will be of great Advantage; it is as commodious as any in Uſe at Sea, and may have Teleſcopial Sights; but I queſtion whether we want them. There are Spots in every *Phaſis* of the *Moon*, viſible to the naked Eye; however this we leave to be conſider'd on. I have been very cautious of amuſing my ſelf or impoſing on my Readers throughout this whole Work, we might have propos'd working by the Moon's *Longitudinal Diſtance*, and of having 2 Min. and 2 Min. and a half to every Degree of Longitude, and the Declination being found, this is alſo found; but it appears to me to be impracticable at Sea, it is an Amuſement with a Shew only of more Facility, but in Reality leſs Certainty, and much more operoſe and difficult; however we leave this alſo among other Things to be conſidered.

WHEN a Man hath nothing to offer but conſpicuous ſimple obvious TRUTH, and matter of Fact as this is, he may be pardon'd for thinking it very impertinent to prove it by Words and Arguments; yet I own ſome Parts of the foregoing Pages are not enough underſtood thro' my Negligence of this. I did not (nor was not willing to) conſider, that here is ſomething, which in the Conſequence may thwart receiv'd Opinions, and People are ſtrangely blinded, even againſt plain matter of Fact, when it is out of their cuſtomary Road; however I have this Satisfaction by theſe Objections, to find my Scheme is more my own than I was afraid they would have admitted, and that I have gone a Length, and carried a Point beyond my Expectation, which, notwithſtanding I have accidentally hit upon, I ſhall now I have it, endeavour to make the beſt Uſe of it the preſent Caſe requires, and trouble my ſelf no further.

I propoſe to conſider the MOON as the SUN, or any common Phænomenon ONLY, as it appears to the Eye, and to take my Obſervation to the ZENITH; yet it is expected by ſome, that I ſhould perplex my Scheme, and my Readers Un-

derſtanding with Diſcourſes on the PARALLAX.

IF I take an Obſervation for the *Moon*'s Place by the Help of one or two fix'd Stars, or if I obſerve it in Conjunction with any Star, or compare it in my Obſervation in any Manner to any REAL VISIBLE *Object*, it would appear different in different Parts of the *Earth*, in Relation to thoſe Objects; for it would be ſeen cloſe with the Object in one Place, and in a diſtant Place very far aſunder, therefore in calculating Eclipſes, where it is conſider'd with the *Sun*, its *Difference* in MAGNITUDE, and DISTANCE from the Sun, muſt be regarded; and here it may be neceſſary to find it a Place among thoſe cœleſtial Appearances, and in order thereunto, ſuppoſe it to be ſeen from the Earth's CENTER, or which is all one, conſider the Earth as one ſingle Point.

BUT we are in this preſent Caſe, entirely out of this Theory, for we bring it to no VISIBLE Object, nor doth its Diſtance from the Earth, or the fix'd Stars, or its Magnitude at all concern us.

WE want only the ANGLE the *Moon* makes, with the *Place* whereon we ſtand to obſerve, and the ZENITH of THAT *Place*.

THE

THE Eye in viewing the *Moon*, or in making ſuch Obſervation, doth all over the Earth place the *Moon* at an INFINITE Diſtance, as it doth the *Sun*, and alſo makes it about the ſame Magnitude.

THE *Zenith* is a Point of no determin'd Height, but may be 10 Miles, 100, or 100,000 Miles high.

THE *Equator* alſo hath no determin'd Height, but the Place whereon my Feet ſtand on the Surface of the Earth, is as far diſtant from the *Equator*, as the *Zenith* 100,000 Miles higher than my Head.

So that let the Moon be 1000 Miles diſtant from the Earth, or one Million of Miles diſtant, it alters neither the *Angle* it makes with the *Zenith*, nor its Diſtance from the *Equator*.

THEREFORE what Buſineſs have we with the Moon's different Horizontal Parallaxes and Equations, when the Reaſon and Intention is anſwer'd, by a juſt Declination being procur'd without them. But the beſt Proof I can give, is to ſet the Way here propos'd, in a clear Light, and give the matter of Fact itſelf as Evidence.

IF at any Diſtance from *London*, I take a true and juſt Obſervation for the

Moon's Visible Apparent *Meridian-Zenith Distance, I have it,* and if I know the true *Latitude* of the Place, then I have the *Zenith* of that Place's true Distance from the *Equator*, and also the Moon's *true visible apparent Distance* from the *Equator*.

If I could observe the *Moon* when on the Meridian of *London*, the same Night, or could have such Observation transmitted to me, then I should also have the Moon's true visible Distance from the *Equator* when it was on the *Meridian* of *London*. And this is the Thing requir'd.

For it is this Difference of Equinoctial Distance, which the *Moon* makes in passing from one Meridian to another, which I propose to work by, for this gives for two thirds of the Month, from 7 or 8 min. an Hour to near 13. See Page 4, 11, 27.

So that all I want is the Means of transmitting the Effects of such an Observation to me, or of knowing by Calculation the true *apparent Equinoctial Distance* when its on the Meridian of *London*, tho' I am at a Distance from it; and this I have propos'd to be done, by taking the Tables, which are made for

for what is called the Moon's real Place, and ſubſtract out of them (by the common well known Ways) the *Parallax*, page 37, and to be certain that we have taken all out: I would have Obſervations made of the *Moon* in all its different *Altitudes* and *Places*. See P. 13, 14, 15.

I deſire alſo that Page 5 and 6 of the *Appendix*, may be conſider'd in Relation to that uſeful Way of correcting the Inaccuracies that may happen, in obſerving for the Moon's *Altitude*; it is true, it may leave ſome Error ſtill on the *Latitude*, but there are ſo many Ways of taking *that*, both by *Sun* and *Stars*, and of correcting them one by another, and by other well known Means, that I think no juſt Objection can be brought; beſides, as I have before ſaid, we want not an Obſervation for our *Longitude*, that is to ſay, our *Eaſting* and *Weſting*, to nearer than 10, 12, or even 15 Leagues; becauſe we have our Latitude very exact, even after this manner to a Mile or two, and altho' I neglected to do my ſelf the Juſtice before, to take Notice of it, yet it muſt be conſider'd that this 10 or 12 or 15 Leagues is ſuppoſing the Courſe to be due Eaſt or Weſt, which very rarely happens; but

if it is to be *South-west* or *North-east*, or the like, we are within just half that Diſtance, that is to 6 or 7 Leagues, and all probable Errors allow'd for.

THE Longitude of Places and Ports which Ships are bound to, will be found to be more truly eſtabliſh'd; but this may be done by Mariners on Shore, by Obſervations for both *Latitude* and *Longitude*; the Inſtrument we propoſe, will make it very eaſy, and may be made into two or three Parts; and (notwithſtanding what *ſpeculative* THEORISTS who know nothing of PRACTICE ſay,) an OBSERVER will find that his VANE will as readily cut to the ſixth of a min. if it is divided to it, as it will to a Deg. if it was divided no nearer.

WHOEVER objects to this, on the Deficiency of human Sight, after ſuch *Preſſions*, *Helps* and *Corrections* are made for it, may like ſome Pedants in Poetry, perhaps find or ſtrain Rules to found Criticiſms on, but if they were ſtrictly regarded, nothing excellent could be brought forth.

SOME of theſe Criticiſms and Cavils may cauſe ſome Delay in bringing it into Practice; but as there is neither Difficulty or Coſt, but what is in the Power of many Hundreds of People in *Great-Britain*, each of which can ſingly compaſs it, I mean Maſters and Mates of Merchant-Ships, and alſo that there are other Nations ready to catch at any probable Offer for the Improvement of Navigation; I cant help expecting to ſee ſome of them who will regard ſo eaſy and practical a Propoſal.